McCausland, IA

Legend
- All Trees
- City Boundary
- Roads

USDA, Iowa State University GIS Facility

2018 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of McCausland with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 15.25% of McCausland's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2018, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 59 trees inventoried.

- McCausland's trees provide $5,689.72 of benefits annually, an average of $96.44 a tree
- There are over 10 species of trees
- The top three genera are: Maple 20.33%, Oak 16.94%, and Ash 15.25%
- 19% of trees are in need of some type of management
- 2 trees are recommended for removal

Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 2 trees needing removal, 1 tree is over 18 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- 8 of the 9 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the proposed budget it could take 6 years to remove ash – Suggestion: request a budget increase to $1,760 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist McCausland with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal or treatment and replacement planting. With proper planning and management of the current canopy in McCausland, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of McCausland's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of McCausland and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet McCausland's urban forestry goals.

Inventory

In 2018, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms associated with EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Inventory Results

The data collected for the 59 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

Annual Benefits

Annual Energy Benefits
Trees conserve energy by shading buildings and blocking winds. McCausland's trees reduce energy related costs by approximately $1,546.07 annually (Appendix A, Table 1). These savings are both in Electricity (7.43 MWh) and in Natural Gas (1,002.07 Therms).

Annual Stormwater Benefits
McCausland's trees intercept about 77,714.77 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $2,106.07 of benefits to the city.

Annual Air Quality Benefits
Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants, and emitting volatile organic matter (ozone). In McCausland it is estimated that trees remove 93.57 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $262.10 (Appendix A, Table 3).

Annual Carbon Benefits
Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In McCausland trees sequester about 15,961.22 lbs of carbon a year with an associated value of $119.71 (Appendix A, Table 5). In addition, the trees store 295,833.80 lbs of carbon, with a yearly benefit of $2,218.75 (Appendix A, Table 4).

Annual Aesthetics Benefits
Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. McCausland receives $1,573.62 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits
According to the USDA Forest Service i-Tree STREETS analysis, McCausland's trees provide $5,689.72 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 59 trees in McCausland provide approximately $96.44 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

McCausland has over 10 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	12	20.33%
Oak	10	16.94%
Ash	9	15.25%
Spruce	8	13.55%
Conifer Small	7	11.86%
Apple	5	8.47%
Hackberry	2	3.38%
Tulip	1	1.69%
American Sycamore	1	1.69%
Siberian Elm	1	1.69%
Linden	1	1.69%
Deciduous Small	1	1.69%
Evergreen Medium	1	1.69%

Age Class

Most of McCausland's trees (75%) are less than 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. McCausland's size curve is on the smaller side, indicating a younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for McCausland indicate that 88% of the trees are in fair to good health, with only 12% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 95% of McCausland's trees are in fair to good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 5% of the population. This 5% is an estimate of trees that need management follow up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Crown Cleaning	5	8.5%
Crown Raising	1	1.7%
Tree Staking	2	3.4%
Tree Removal	2	3.4%

<div align="center">Crown Reduction   1   1.7%</div>

Canopy Cover
The total canopy with both private and public trees is 17%, 61 acres. The canopy cover included in the McCausland inventory includes approximately .83 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal it is estimated that 26 trees need to be planted annually.

Land Use and Location
The majority of McCausland's city and park trees are in the park. (Appendix A, Figure 6 & Appendix A, Figure 7). The following describes the land use and locations for the street and park trees.

<u>Land Use</u>

Single family residential	30.51%
Park/vacant/other	67.8%
Industrial/Large commercial	0.0%
Small commercial	1.69%

<u>Location</u>

Planting strip	86.44%
Other maintained locations	0.0%
Cutout (surrounded by pavement)	0.0%
Front yard	6.78%

Recommendations

Risk Management
Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals, etc should be removed.

<u>Hazardous trees</u>
McCausland has 2 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There is 1 tree over 18 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There is a total of 9 trees with these needs.

<u>Poor tree species</u>
After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). The 2 removals are both ash trees. There are a total of 9 ash trees, and 8 of those have signs (epicormic sprouts) and symptoms that have been associated with

EAB. In addition, there are 3 trees that are in poor health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

Planting

Most of the planting over the next 5 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in McCausland.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is predominantly planted with maple (20%) (Appendix A, Figure 1). Maples should not be planted at this time. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Six Year Maintenance Plan with No Additional Funding

Year 1
    Removal: 1 critical concern tree
    Planting and Replacement: 2 trees to be planted in open locations
    Young Tree Pruning & Maintenance:
    Visual Survey for signs and symptoms of EAB

Year 2
    Removal: 1 critical concern tree

Planting and Replacement: 2 trees to be planted in open locations
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3
Removal: 2 ash trees in poor condition
Planting and Replacement: 4 trees to be planted in open
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 4
Removal: 2 ash trees in poor condition
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 4 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 5
Removal: 2 ash trees
Planting and Replacement: 4 trees in open locations from previous removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 6
Removal: 3 ash trees - removal of any new critical concern trees and ash in poor health
Planting and Replacement: 6 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: All 9 ash trees removed. EAB could potentially kill all ash within 4 to 15 years of its arrival.
**To remove all ash trees within 6 years, the budget would need to be $1760 a year

Emerald Ash Borer Plan

Ash Tree Removal
Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

Treatment of Ash Trees

Chemical treatment can be effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from the community. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of millions of ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:
- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)
- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 151.06 states "If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Budget

Current Budget

Total $10,550 over 6 years ($1760/year)

FY 2019 Budget

    Removal: $700
    *Or saving for ash tree treatment and/or future ash removal
    Planting: $200
    Watering & Maintenance: $100

FY 2020 Budget

    Removal: $700
    *Or saving for ash tree treatment and/or future ash removal
    Planting: $200
    Routine trimming: $250
    Watering & Maintenance: $100

FY 2021 Budget

    Removal: $1400
    *Or saving for ash tree treatment and/or future ash removal
    Planting: $400
    Watering & Maintenance: $100

FY 2022 Budget

    Removal: $700
    *Or saving for ash tree treatment and/or future ash removal
    Planting: $400

Routine trimming: $250
Watering & Maintenance: $100

FY 2023 Budget
Removal: $1400
*Or saving for ash tree treatment and/or future ash removal
Planting: $400
Watering & Maintenance: $100

FY 2024 Budget
Removal: $2100
*Or saving for ash tree treatment and/or future ash removal
Planting: $600
Routine trimming: $250
Watering & Maintenance: $100

*Reduction of ash over 6 years: All 9 ash trees removed

Purposed Budget Increase
EAB could potentially kill all ash trees in McCausland within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be $1760 a year. Additionally, it is recommended that McCausland apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For instance, in this treatment scenario, the average ash diameter is 20 inches and at $12 per inch, about 4 trees could be treated ($960) per year (1/2 treatable ash every other year treatment). This would be 7 total trees selected for treatment, and McClausland would still need to find $700 for removal. Alternatively, if there are 7 treated trees every other year, it would cost approximately $1920 every 2 years for treatment and leave $0 for removal and $0 for planting. These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees when EAB is found in Tipton. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of All Trees by Species					12/20/2018				
Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1.64	124.20	223.23	218.76	342.97	(N/A)	15.25	22.18	38.11
Conifer Evergreen Small	0.03	1.93	4.67	4.57	6.50	(N/A)	11.86	0.42	0.93
Northern red oak	1.14	86.56	157.32	154.17	240.73	(N/A)	8.47	15.57	48.15
Silver maple	1.30	98.55	160.10	156.90	255.45	(N/A)	8.47	16.52	51.09
Apple	0.42	31.54	57.55	56.40	87.94	(N/A)	8.47	5.69	17.59
Norway spruce	0.01	1.10	2.66	2.61	3.71	(N/A)	6.78	0.24	0.93
Bur oak	0.01	0.80	1.86	1.83	2.62	(N/A)	6.78	0.17	0.66
Red maple	0.29	22.26	43.47	42.60	64.86	(N/A)	6.78	4.19	16.21
Spruce	0.01	0.82	1.99	1.95	2.78	(N/A)	5.08	0.18	0.93
Northern hackberry	0.91	69.23	126.73	124.20	193.43	(N/A)	3.39	12.51	96.71
Sugar maple	0.38	28.52	50.70	49.69	78.20	(N/A)	3.39	5.06	39.10
Tulip tree	0.00	0.20	0.47	0.46	0.66	(N/A)	1.69	0.04	0.66
Blue spruce	0.01	0.47	1.20	1.17	1.65	(N/A)	1.69	0.11	1.65
Broadleaf Evergreen Medium	0.27	20.40	36.32	35.59	55.99	(N/A)	1.69	3.62	55.99
Siberian elm	0.24	17.98	26.84	26.31	44.29	(N/A)	1.69	2.86	44.29
American sycamore	0.48	36.79	63.11	61.85	98.63	(N/A)	1.69	6.38	98.63
Broadleaf Deciduous Small	0.00	0.25	0.62	0.61	0.87	(N/A)	1.69	0.06	0.87
Littleleaf linden	0.28	21.62	41.91	41.07	62.69	(N/A)	1.69	4.05	62.69
Maple	0.00	0.31	0.74	0.72	1.03	(N/A)	1.69	0.07	1.03
Swamp white oak	0.00	0.33	0.79	0.78	1.10	(N/A)	1.69	0.07	1.10
Total	7.43	563.84	1,002.27	982.23	1,546.07	(N/A)	100.00	100.00	26.20

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of All Trees by Species			12/20/2018		
Species	Total Rainfall Interception (Gal)	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	13,134.58	355.95	(N/A)	15.25	16.90	39.55
Conifer Evergreen Small	171.42	4.65	(N/A)	11.86	0.22	0.66
Northern red oak	11,331.69	307.09	(N/A)	8.47	14.58	61.42
Silver maple	17,215.46	466.54	(N/A)	8.47	22.15	93.31
Apple	1,477.83	40.05	(N/A)	8.47	1.90	8.01
Norway spruce	194.96	5.28	(N/A)	6.78	0.25	1.32
Bur oak	71.54	1.94	(N/A)	6.78	0.09	0.48
Red maple	1,525.12	41.33	(N/A)	6.78	1.96	10.33
Spruce	146.22	3.96	(N/A)	5.08	0.19	1.32
Northern hackberry	11,477.35	311.04	(N/A)	3.39	14.77	155.52
Sugar maple	5,340.85	144.74	(N/A)	3.39	6.87	72.37
Tulip tree	17.88	0.48	(N/A)	1.69	0.02	0.48
Blue spruce	38.12	1.03	(N/A)	1.69	0.05	1.03
Broadleaf Evergreen Medium	3,187.16	86.37	(N/A)	1.69	4.10	86.37
Siberian elm	1,370.50	37.14	(N/A)	1.69	1.76	37.14
American sycamore	7,238.92	196.17	(N/A)	1.69	9.31	196.17
Broadleaf Deciduous Small	7.45	0.20	(N/A)	1.69	0.01	0.20
Littleleaf linden	3,743.85	101.46	(N/A)	1.69	4.82	101.46
Maple	11.68	0.32	(N/A)	1.69	0.02	0.32
Swamp white oak	12.20	0.33	(N/A)	1.69	0.02	0.33
Citywide total	77,714.77	2,106.07	(N/A)	100.00	100.00	35.70

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of All Trees by Species					12/20/2018												
Species	Deposition O3 (lb)	Deposition NO2 (lb)	Deposition PM10 (lb)	Deposition SO2 (lb)	Total Deposition ($)	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Stand. Error	% of Total Trees	Avg. $/tree
Green ash	1.11	0.18	0.63	0.05	6.20	7.80	1.14	1.08	7.42	48.64	0.00	0.00	19.41	54.84	(N/A)	15.25	6.09
Conifer Evergreen Small	0.00	0.00	0.01	0.00	0.03	0.13	0.02	0.02	0.12	0.80	- 0.06	- 0.23	0.23	0.60	(N/A)	11.86	0.09
Northern red oak	2.39	0.41	1.16	0.11	12.88	5.45	0.79	0.76	5.17	33.92	- 3.39	- 12.72	12.84	34.08	(N/A)	8.47	6.82
Silver maple	2.82	0.48	1.40	0.12	15.23	6.03	0.89	0.85	5.88	37.95	- 1.49	- 5.58	16.97	47.60	(N/A)	8.47	9.52
Apple	0.42	0.07	0.20	0.02	2.26	1.99	0.29	0.28	1.88	12.38	0.00	- 0.01	5.15	14.64	(N/A)	8.47	2.93
Norway spruce	0.00	0.00	0.00	0.00	0.02	0.08	0.01	0.01	0.07	0.46	- 0.07	- 0.27	0.10	0.20	(N/A)	6.78	0.05
Bur oak	0.00	0.00	0.00	0.00	0.00	0.05	0.01	0.01	0.05	0.33	0.00	0.00	0.12	0.33	(N/A)	6.78	0.08
Red maple	0.17	0.03	0.11	0.01	1.00	1.42	0.21	0.20	1.33	8.81	- 0.08	- 0.29	3.40	9.52	(N/A)	6.78	2.38
Spruce	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.01	0.05	0.34	- 0.05	- 0.20	0.07	0.15	(N/A)	5.08	0.05
Northern hackberry	2.10	0.36	1.02	0.09	11.30	4.38	0.64	0.61	4.14	27.22	0.00	0.00	13.33	38.53	(N/A)	3.39	19.26
Sugar maple	0.79	0.13	0.37	0.03	4.20	1.79	0.26	0.25	1.70	11.14	- 0.60	- 2.26	4.72	13.09	(N/A)	3.39	6.54
Tulip tree	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.08	0.00	0.00	0.03	0.08	(N/A)	1.69	0.08
Blue spruce	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.03	0.20	- 0.01	- 0.03	0.07	0.18	(N/A)	1.69	0.18
Broadleaf Evergreen Medium	0.31	0.06	0.31	0.04	2.21	1.27	0.18	0.18	1.20	7.90	- 0.93	- 3.47	2.63	6.63	(N/A)	1.69	6.63
Siberian elm	0.11	0.02	0.07	0.00	0.63	1.08	0.16	0.15	1.07	6.86	0.00	0.00	2.67	7.49	(N/A)	1.69	7.49
American sycamore	1.59	0.25	0.69	0.07	8.24	2.29	0.33	0.32	2.20	14.31	0.00	0.00	7.73	22.55	(N/A)	1.69	22.55
Broadleaf Deciduous Small	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.11	0.00	0.00	0.04	0.11	(N/A)	1.69	0.11
Littleleaf linden	0.72	0.12	0.35	0.03	3.88	1.39	0.20	0.19	1.29	8.58	- 0.33	- 1.25	3.96	11.21	(N/A)	1.69	11.21
Maple	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.13	0.00	0.00	0.05	0.13	(N/A)	1.69	0.13
Swamp white oak	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.13	0.00	0.00	0.05	0.14	(N/A)	1.69	0.14
Citywide Total	12.53	2.12	6.33	0.58	68.13	35.31	5.15	4.91	33.64	220.29	- 7.02	- 26.32	93.57	262.10	(N/A)	100.00	4.44

Table 4: Annual Carbon Stored

Stored CO2 Benefits of All Trees by Species			12/20/2018			
Species	Total stored CO2 (lbs)	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	36,854.82	276.41	(N/A)	15.25	12.46	30.71
Conifer Evergreen Small	17.52	0.13	(N/A)	11.86	0.01	0.02
Northern red oak	50,508.85	378.82	(N/A)	8.47	17.07	75.76
Silver maple	63,745.28	478.09	(N/A)	8.47	21.55	95.62
Apple	6,443.68	48.33	(N/A)	8.47	2.18	9.67
Norway spruce	9.89	0.07	(N/A)	6.78	0.00	0.02
Bur oak	48.66	0.36	(N/A)	6.78	0.02	0.09
Red maple	2,638.27	19.79	(N/A)	6.78	0.89	4.95
Spruce	7.42	0.06	(N/A)	5.08	0.00	0.02
Northern hackberry	34,019.97	255.15	(N/A)	3.39	11.50	127.57
Sugar maple	22,822.64	171.17	(N/A)	3.39	7.71	85.58
Tulip tree	12.16	0.09	(N/A)	1.69	0.00	0.09
Blue spruce	2.25	0.02	(N/A)	1.69	0.00	0.02
Broadleaf Evergreen Medium	4,396.85	32.98	(N/A)	1.69	1.49	32.98
Siberian elm	3,037.16	22.78	(N/A)	1.69	1.03	22.78
American sycamore	55,981.98	419.86	(N/A)	1.69	18.92	419.86
Broadleaf Deciduous Small	13.78	0.10	(N/A)	1.69	0.00	0.10
Littleleaf linden	15,238.94	114.29	(N/A)	1.69	5.15	114.29
Maple	16.84	0.13	(N/A)	1.69	0.01	0.13
Swamp white oak	16.84	0.13	(N/A)	1.69	0.01	0.13
Citywide total	295,833.80	2,218.75	(N/A)	100.00	100.00	37.61

Table 5: Annual Carbon Sequestered

Annual CO2 Benefits of All Trees by Species										12/20/2018			
Species	Sequestered (lb)	Sequestered ($)	Decomposition Release(lb)	Maintenance Release (lb)	Total Release ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	3,704.93	27.79	- 176.90	- 16.77	- 1.45	2,744.89	20.59	6,256.15	46.92	(N/A)	15.25	23.24	5.21
Conifer Evergreen Small	4.15	0.03	- 0.14	- 1.37	- 0.01	42.70	0.32	45.34	0.34	(N/A)	11.86	0.17	0.05
Northern red oak	1,784.91	13.39	- 242.44	- 14.43	- 1.93	1,912.87	14.35	3,440.91	25.81	(N/A)	8.47	12.78	5.16
Silver maple	4,873.35	36.55	- 306.03	- 13.46	- 2.40	2,177.89	16.33	6,731.75	50.49	(N/A)	8.47	25.01	10.10
Apple	619.84	4.65	- 30.97	- 5.27	- 0.27	696.97	5.23	1,280.57	9.60	(N/A)	8.47	4.76	1.92
Norway spruce	14.14	0.11	- 0.08	- 0.78	- 0.01	24.30	0.18	37.58	0.28	(N/A)	6.78	0.14	0.07
Bur oak	10.37	0.08	- 0.39	- 0.78	- 0.01	17.58	0.13	26.79	0.20	(N/A)	6.78	0.10	0.05
Red maple	407.99	3.06	- 12.66	- 3.51	- 0.12	491.89	3.69	883.71	6.63	(N/A)	6.78	3.28	1.66
Spruce	10.60	0.08	- 0.06	- 0.59	0.00	18.22	0.14	28.18	0.21	(N/A)	5.08	0.10	0.07
Northern hackberry	1,325.83	9.94	- 163.30	- 9.36	- 1.29	1,529.94	11.47	2,683.11	20.12	(N/A)	3.39	9.97	10.06
Sugar maple	1,012.73	7.60	- 109.60	- 4.49	- 0.86	630.24	4.73	1,528.89	11.47	(N/A)	3.39	5.68	5.73
Tulip tree	2.59	0.02	- 0.10	- 0.20	0.00	4.40	0.03	6.70	0.05	(N/A)	1.69	0.02	0.05
Blue spruce	1.72	0.01	- 0.02	- 0.20	0.00	10.40	0.08	11.91	0.09	(N/A)	1.69	0.04	0.09
Broadleaf Evergreen Medium	259.79	1.95	- 21.10	- 2.73	- 0.18	450.85	3.38	686.81	5.15	(N/A)	1.69	2.55	5.15
Siberian elm	314.29	2.36	- 14.58	- 1.95	- 0.12	397.37	2.98	695.14	5.21	(N/A)	1.69	2.58	5.21
American sycamore	478.87	3.59	- 268.71	- 5.85	- 2.06	812.94	6.10	1,017.24	7.63	(N/A)	1.69	3.78	7.63
Broadleaf Deciduous Small	8.68	0.07	- 0.11	- 0.20	0.00	5.61	0.04	13.99	0.10	(N/A)	1.69	0.05	0.10
Littleleaf linden	1,118.21	8.39	- 73.15	- 3.51	- 0.57	477.74	3.58	1,519.29	11.39	(N/A)	1.69	5.64	11.39
Maple	2.81	0.02	- 0.13	- 0.20	0.00	6.80	0.05	9.28	0.07	(N/A)	1.69	0.03	0.07
Swamp white oak	5.42	0.04	- 0.13	- 0.20	0.00	7.19	0.05	12.28	0.09	(N/A)	1.69	0.05	0.09
Citywide Total	15,961.22	119.71	- 1,420.62	- 85.80	- 11.30	12,460.81	93.46	26,915.62	201.87	(N/A)	100.00	100.00	3.42

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefit of All Trees by Species				12/20/2018	
Species	Total ($)	Stand. Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	379.00	(N/A)	15.25	24.08	42.11
Conifer Evergreen Small	29.88	(N/A)	11.86	1.90	4.27
Northern red oak	126.70	(N/A)	8.47	8.05	25.34
Silver maple	397.80	(N/A)	8.47	25.28	79.56
Apple	35.11	(N/A)	8.47	2.23	7.02
Norway spruce	23.04	(N/A)	6.78	1.46	5.76
Bur oak	21.05	(N/A)	6.78	1.34	5.26
Red maple	74.24	(N/A)	6.78	4.72	18.56
Spruce	17.28	(N/A)	5.08	1.10	5.76
Northern hackberry	151.07	(N/A)	3.39	9.60	75.53
Sugar maple	97.52	(N/A)	3.39	6.20	48.76
Tulip tree	5.26	(N/A)	1.69	0.33	5.26
Blue spruce	5.03	(N/A)	1.69	0.32	5.03
Broadleaf Evergreen Medium	41.22	(N/A)	1.69	2.62	41.22
Siberian elm	32.00	(N/A)	1.69	2.03	32.00
American sycamore	28.57	(N/A)	1.69	1.82	28.57
Broadleaf Deciduous Small	0.03	(N/A)	1.69	0.00	0.03
Littleleaf linden	106.03	(N/A)	1.69	6.74	106.03
Maple	0.04	(N/A)	1.69	0.00	0.04
Swamp white oak	2.74	(N/A)	1.69	0.17	2.74
Citywide Total	1,573.62	(N/A)	100.00	100.00	26.67

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of All Tree by Species ($/tree)					12/20/2018		
Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total	Stand. E
Green ash	38.11	5.21	6.09	39.55	42.11	131.07	(N/A)
Conifer Evergreen Small	0.93	0.05	0.09	0.66	4.27	6.00	(N/A)
Northern red oak	48.15	5.16	6.82	61.42	25.34	146.88	(N/A)
Silver maple	51.09	10.10	9.52	93.31	79.56	243.58	(N/A)
Apple	17.59	1.92	2.93	8.01	7.02	37.47	(N/A)
Norway spruce	0.93	0.07	0.05	1.32	5.76	8.13	(N/A)
Bur oak	0.66	0.05	0.08	0.48	5.26	6.53	(N/A)
Red maple	16.21	1.66	2.38	10.33	18.56	49.14	(N/A)
Spruce	0.93	0.07	0.05	1.32	5.76	8.13	(N/A)
Northern hackberry	96.71	10.06	19.26	155.52	75.53	357.09	(N/A)
Sugar maple	39.10	5.73	6.54	72.37	48.76	172.51	(N/A)
Tulip tree	0.66	0.05	0.08	0.48	5.26	6.53	(N/A)
Blue spruce	1.65	0.09	0.18	1.03	5.03	7.97	(N/A)
Broadleaf Evergreen Medium	55.99	5.15	6.63	86.37	41.22	195.37	(N/A)
Siberian elm	44.29	5.21	7.49	37.14	32.00	126.14	(N/A)
American sycamore	98.63	7.63	22.55	196.17	28.57	353.55	(N/A)
Broadleaf Deciduous Small	0.87	0.10	0.11	0.20	0.03	1.31	(N/A)
Littleleaf linden	62.69	11.39	11.21	101.46	106.03	292.77	(N/A)
Maple	1.03	0.07	0.13	0.32	0.04	1.58	(N/A)
Swamp white oak	1.10	0.09	0.14	0.33	2.74	4.40	(N/A)
Citywide Total	26.20	3.42	4.44	35.70	26.67	96.44	(N/A)

Legend:
- Green ash
- Conifer Evergreen Small
- Northern red oak
- Silver maple
- Apple
- Norway spruce
- Bur oak
- Red maple
- Spruce
- Northern hackberry
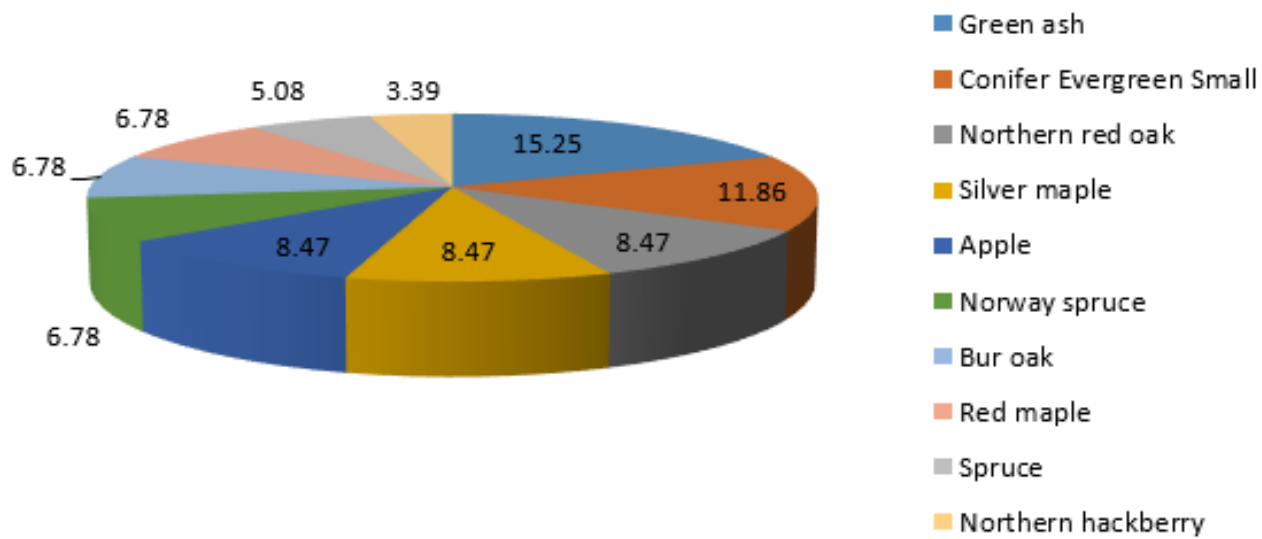
Species Distribution of All Trees for 1 12/20/2018	
Species	Percent
Green ash	15.25
Conifer Evergreen Small	11.86
Northern red oak	8.47
Silver maple	8.47
Apple	8.47
Norway spruce	6.78
Bur oak	6.78
Red maple	6.78
Spruce	5.08
Northern hackberry	3.39
Other Species	18.64

Figure 1: Species Distribution

Relative Age Distribution of Top 10 All Tree Species (%)
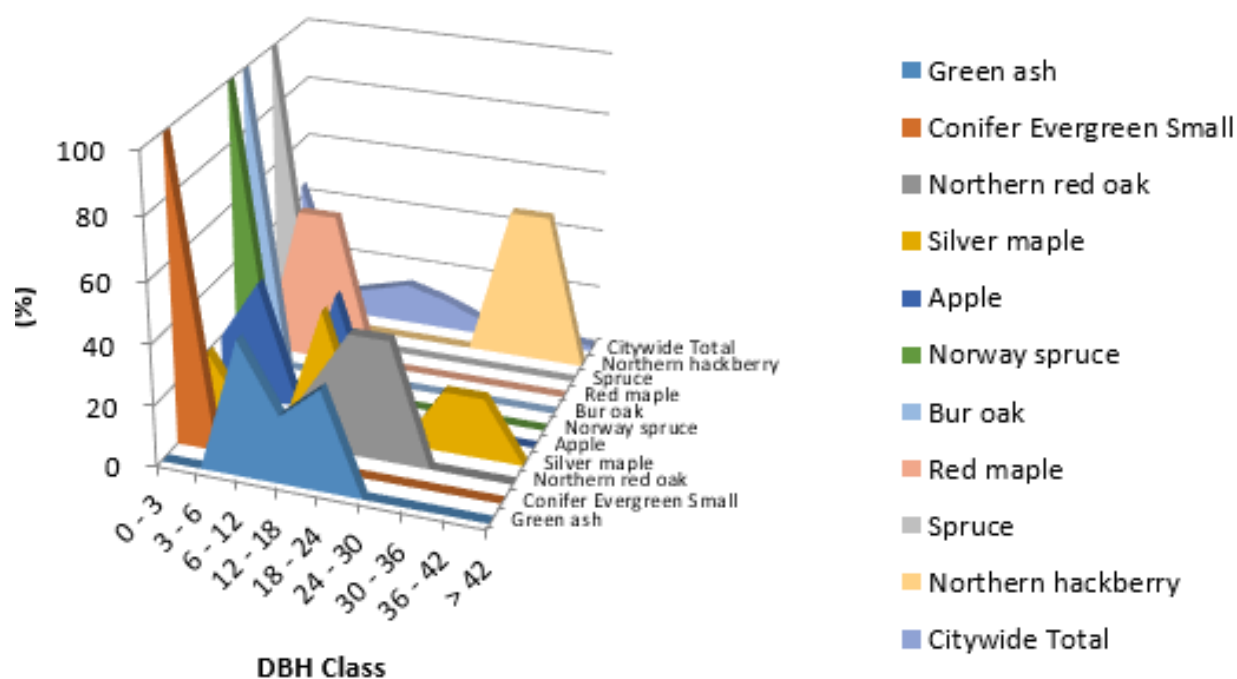
Relative Age Distribution	DBH class (in)				12/20/2018				
Species	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	> 42
Green ash	0.00	0.00	44.44	22.22	33.33	0.00	0.00	0.00	0.00
Conifer Evergreen Small	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern red oak	0.00	0.00	0.00	20.00	40.00	40.00	0.00	0.00	0.00
Silver maple	20.00	0.00	0.00	40.00	0.00	0.00	20.00	20.00	0.00
Apple	20.00	40.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00
Norway spruce	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bur oak	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red maple	0.00	50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00
Spruce	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern hackberry	0.00	0.00	0.00	0.00	0.00	0.00	50.00	50.00	0.00
Citywide Total	44.07	6.78	10.17	13.56	10.17	5.08	5.08	3.39	1.69

Figure 2: Relative Age Class

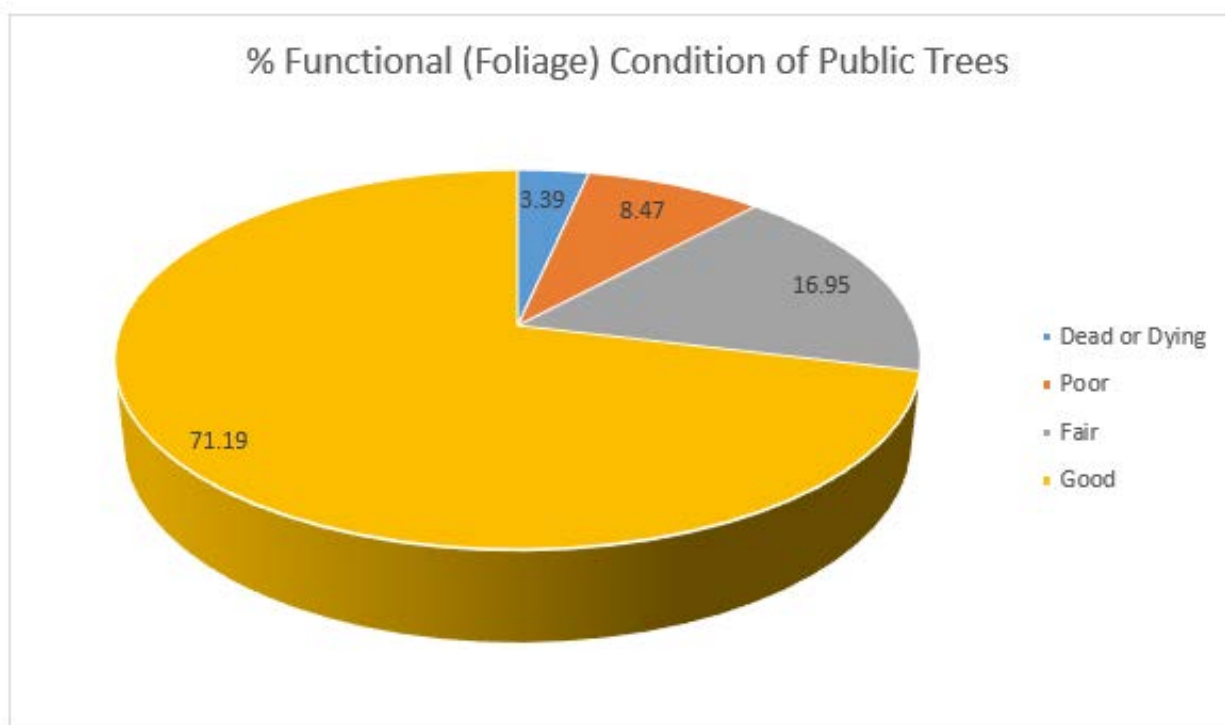**Figure 3: Foliage Condition**
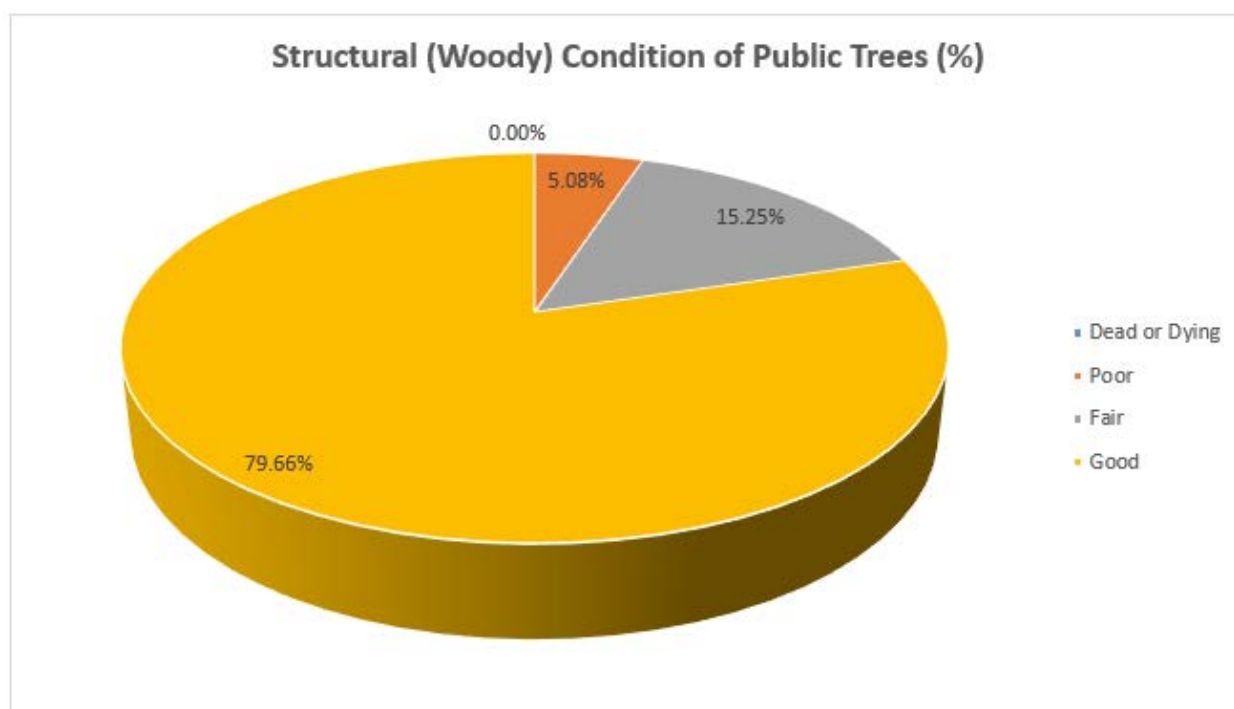
Figure 4: Wood Condition

Canopy Cover of All Trees (Acres)
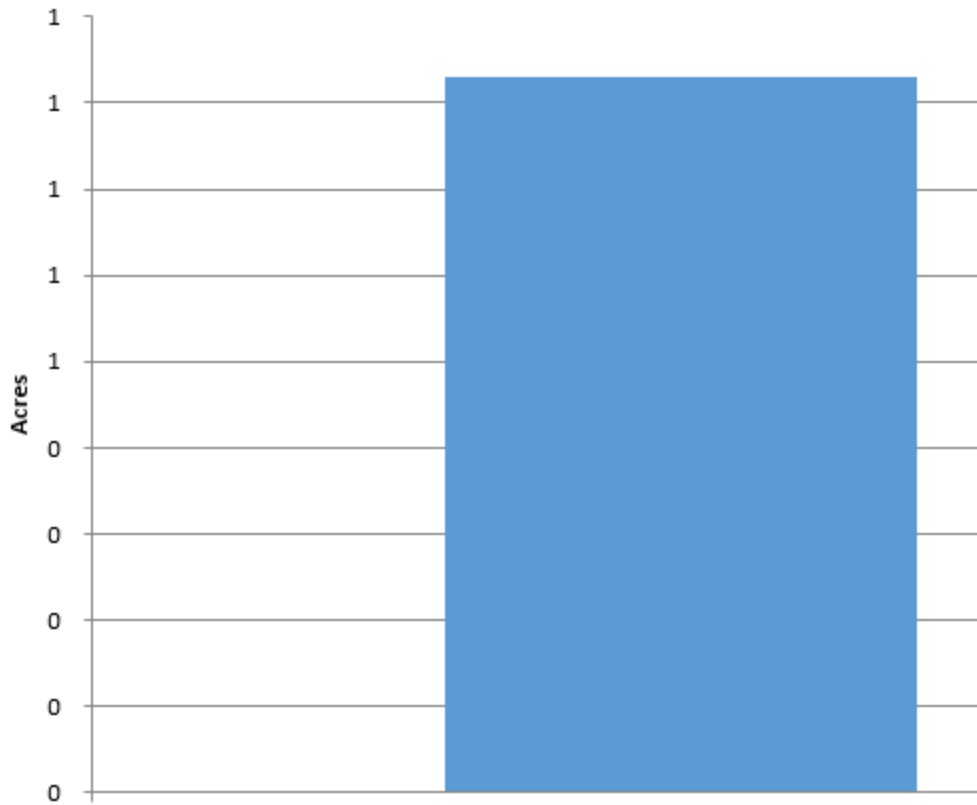
Canopy Cover of All Trees (Acres)		12/20/2018
Zone	Acres	% of Total Canopy
1	0.83	4.90
Citywide Total	17.00	100.00

Figure 5: Canopy Cover in Acres

% Land Use of Public Trees

	Single Family Residential	Multi Family Residential	Industrial Large Commercial	Park/vacant/other	Small Commercial
Category 1	31%	0.00%	0	68%	1.69%

Figure 6: Land Use of city/park trees

% Location of Public Trees

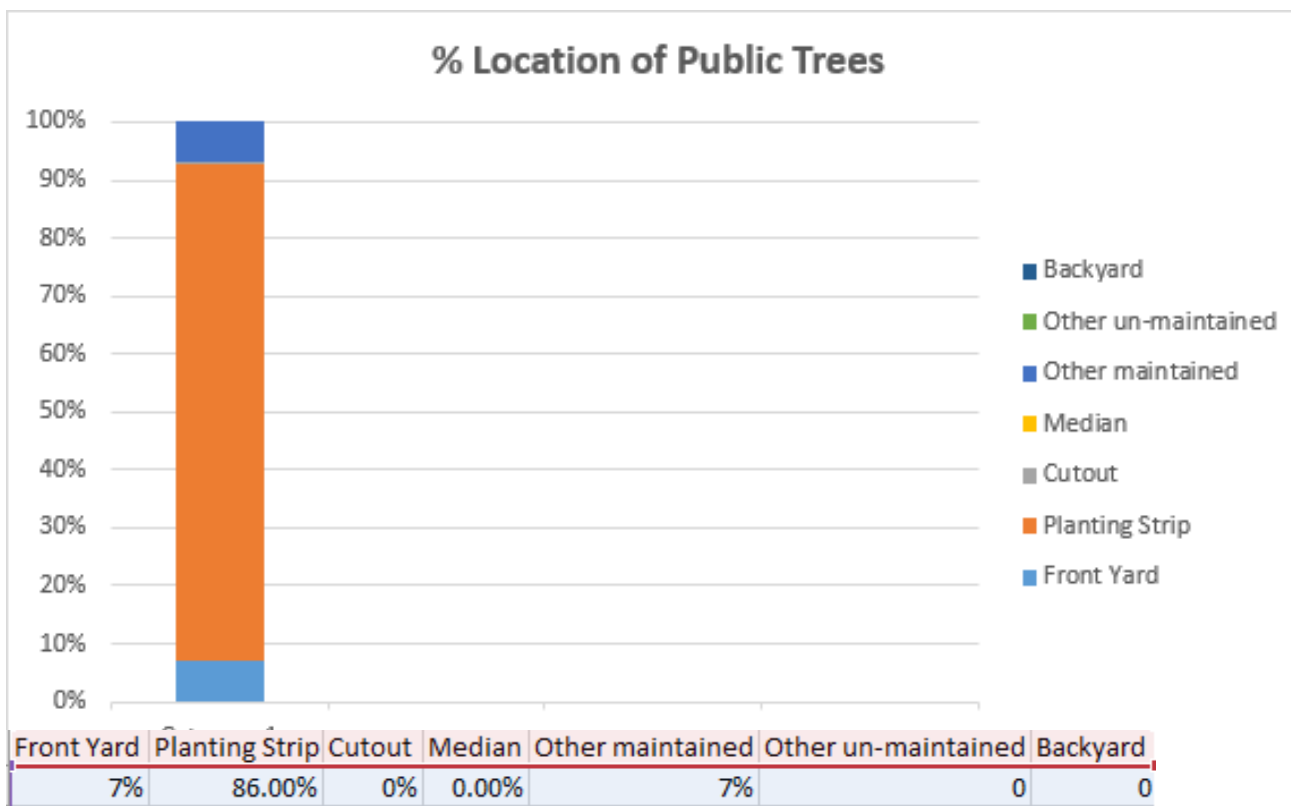| Front Yard	Planting Strip	Cutout	Median	Other maintained	Other un-maintained	Backyard
7%	86.00%	0%	0.00%	7%	0	0

Figure 7: Location of city/park trees

Figure 1:

Location of Ash Trees
2018 Community Tree Inventory
McCausland, IA

Legend
- 🌿 Ash
- 🌲 Green ash
- ⚫ Black ash
- 🟡 White ash
- City Boundary
- Roads

USDA, Iowa State University GIS Facility

Location of EAB Symptoms
2018 Community Tree Inventory
McCausland, IA

Legend

🟠 Canopy Dieback

🟢 Epicormic Shoots

▲ Woodpecker Damage

⬡ City Boundary

〰 Roads

Location of Poor Condition Trees
2018 Community Tree Inventory
McCausland, IA

Legend

Leaf Condition
- ● Dead or Dying
- ○ Fair
- ○ Poor

Wood Condition
- ▲ Dead or Dying
- ▲ Poor
- ▲ Fair
- City Boundary
- Roads
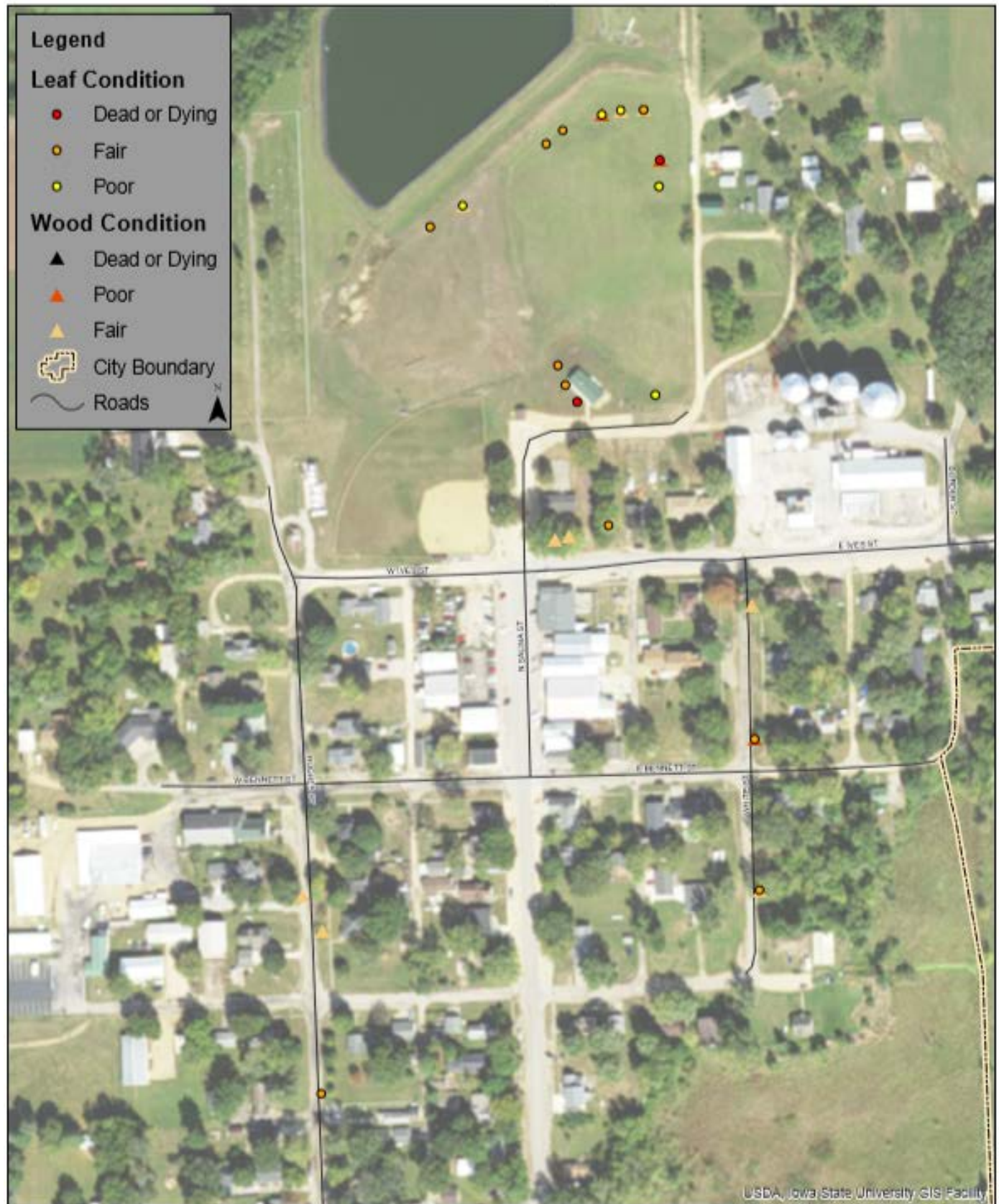
Location of Trees with Recommended Maintenance
2018 Community Tree Inventory
McCausland, IA

Legend
- Critical Concern
- Mature Tree Immediate
- Mature Tree Routine
- Young Tree Immediate
- Young Tree Routine
- City Boundary
- Roads
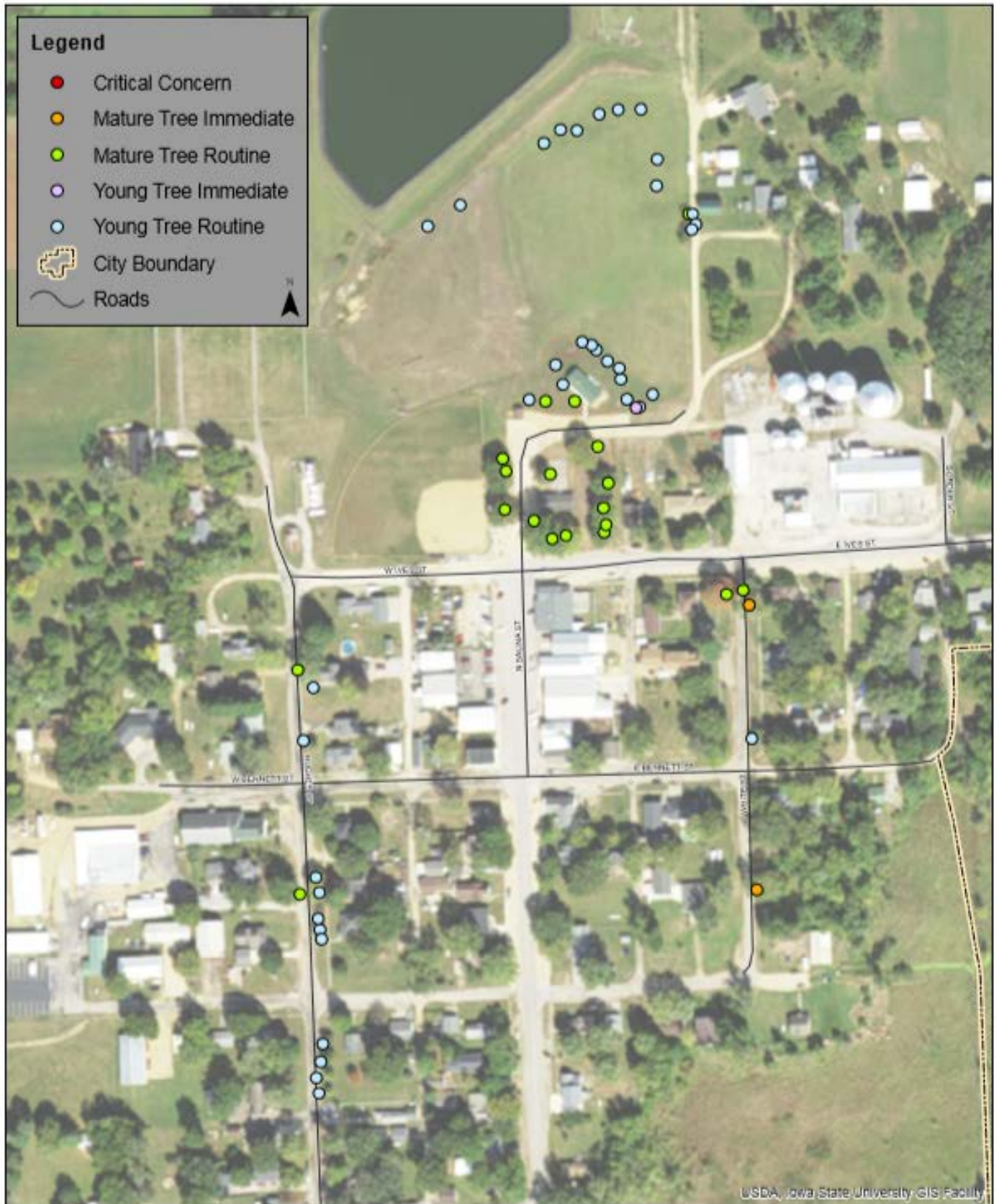
Figure 5:

Maintenance Tasks
2018 Community Tree Inventory
McCausland, IA

Legend

- ○ Clean
- ○ Stake/Train
- ○ Raise
- ○ Reduce
- ○ Remove
- ○ Treat pest/disease
- City Boundary
- Roads

N

Figure 6:

Location of Treatable Ash Trees
2018 Community Tree Inventory
McCausland, IA

Legend

- Treatable
- City Boundary
- Roads

CHAPTER 151

TREES

151.01 Definition
151.02 Planting Restrictions
151.03 Duty to Trim Trees

151.04 Trimming Trees to be Supervised
151.05 Disease Control
151.06 Inspection and Removal

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue, or highway in the City not covered by sidewalk and lying between the lot line and the curb line or, on unpaved streets, that part of the street, avenue, or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted in any parking or street except in accordance with the following:

1. Alignment. All trees planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.

2. Spacing. Trees shall not be planted on any parking that is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow, or black walnut.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.
(Code of Iowa, Sec. 364.12[2c, d & e])

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased, or damaged tree or shrub that may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

CODE OF ORDINANCES, McCAUSLAND, IOWA
- 547 -

1.   City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2.   Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant, or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.
(Code of Iowa, Sec. 364.12[3b & h])

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The State of Iowa is an Equal Opportunity Employer and provider of ADA services.

Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E 9th St, Des Moines IA 50319.

If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-725-8200.